



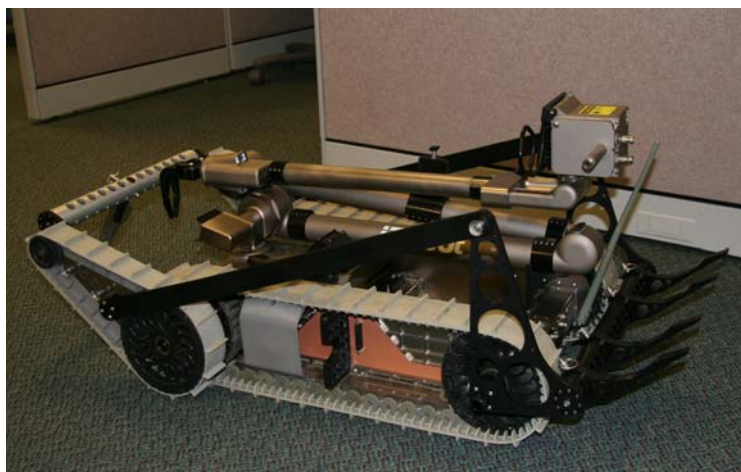
ROBOTICS UPDATE

"Providing network-integrated robotic solutions for C4ISR applications."

www.spawar.navy.mil/robots/

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IED Spiral Development



iRobot lift mechanism (right) with toolkit integration (left).

The successful use of robotic systems by joint-service explosive-ordnance-disposal (EOD) technicians on the battlefields of Iraq and Afghanistan has already saved the lives of countless warfighters, resulting in widespread user acceptance and significantly increased demand. In-theater feedback from the initial deployment of more than 200 systems to counter the threat of improvised explosive devices (IEDs), more commonly known as road-

side bombs, has resulted in a number of valuable lessons learned. One overarching problem was the use of existing robotic manipulator arms to excavate buried IEDs, a task for which they were not originally designed, resulting in premature failures. To address this vulnerability, Space and Naval Warfare Systems Center (SSC San Diego) put out a call to the principal vendors of deployed systems, iRobot and Foster Miller, for a more robust solution.

Engineers from iRobot responded with a conceptual bulldozer-blade design that could be attached to the Packbot's flippers. At SSC San Diego, Erin Wickstrand, an Office of Naval Research summer intern (recently hired as a New Professional), was tasked with enhancing this concept to incorporate a universal tool mount that could accept a variety of excavation as well as neutralization implements. The intent was to provide for simple field interchange of common EOD tools, as well as to facilitate future incorporation of emergent solutions as



Erin Wickstrand (SSC San Diego) with her quick-disconnect toolbar.

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MDARS Completes EUA

The Mobile Detection Assessment Response System (MDARS) recently completed a successful Early User Appraisal (EUA) period at Hawthorne Army Depot (HWAD) in Nevada, the largest Army depot in the world. MDARS, a joint Army-Navy development effort to provide automated intrusion detection and inventory assessment capability for use on DoD facilities, is managed by the US Army Office of the Product Manager, Force Protection Systems (PM-FPS). The *Multiple Resource Host Architecture (MRHA)* command-and-control software was developed by SSC San Diego, while the unmanned ground vehicle (UGV) was developed by General Dynamics Robotic Systems (GDRS). The MDARS system, (four UGVs, command-and-control console/software, and communications equipment) was installed at Hawthorne in 2004. Site personnel were trained for a number of MDARS positions, including



Theresa Dillon, Systems Operator at Hawthorne, performs testing at the MDARS Guard Operation Center (GOC).

system operators, administrators, and maintainers. During the month-long EUA, which concluded in April 2005, the autonomous UGVs patrolled assigned portions of the depot for 12 hours per day on weekdays and 24 hours per day on



Chinh Nguyen (SSC San Diego) setting up the MDARS vehicle for a test run at Hawthorne Army Depot.

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PackBot Toolkit (continued)



SFC Wilson and SGT Treanbeth perform operational pre-checks on a combined tool/lift kit in preparation for deployment.

needs arise and tactics change. An initial prototype was fabricated at SSC San Diego to gather hands-on feedback from local EOD teams.

These preliminary evaluation trials were most favorable, resulting in very helpful user insights, along with a request for a heavy-lift capability beyond that achievable with the flipper configuration. This need was already being addressed by iRobot engineers in the form of a lift mechanism mounted on the rear of the Packbot, which gains significant mechanical advantage through the actuator linkages that attach it to the flippers. Initial tests showed this approach capable of lifting and transporting a 155-millimeter artillery shell weighing 85 pounds. SSC San Diego then



Packbot tool with excavation and wire-cutting tools.

funded iRobot Corporation to produce seven prototypes of an integrated design, which incorporates a common attachment point for the flippers. This standardized approach allows for mounting the toolbar adaptor on the front, the lift mechanism on the back, or even both at the same time.

The SSC San Diego Robotics Systems Combat Support Platoon (RSCSP) has since produced additional tool attachments. CDR Ritchie Dao of San Jose Reserve Unit #220, a mechanical engineer at Applied Materials out of Sunnyvale, CA, designed and fabricated a combination wire-cutting/excavating tool that received very favorable user feedback, and was subsequently replicated for inclusion with each of the seven initial evaluation kits for field testing, both in country and in theater.

Two of the combined tool/lift kits were used during Army pre-deployment training at Ft. Polk, LA, and Marine pre-deployment training at Camp Pendleton, CA. Other kits are being evaluated by Marine EOD techs in Afghanistan and an Army EOD unit in Iraq. Further testing and evaluation will be coordinated by the Naval EOD Technology Division (NAVEODTECHDIV) in Indian Head, MD. ♦

MDARS EUA (continued)

weekends. Their mission included intruder detection, monitoring of high-security locks on munitions bunkers, and tracking of the presence/location of tagged munitions using active

operators became very comfortable with normal operation, and acquired additional proficiency in responding to exceptional events such as intruders and open locks. Automated



Michal Grinnell preparing MDARS unit for mission at Hawthorne.

RFID technology.

The MDARS console was operated by Hawthorne personnel, with representatives of the program office introducing selected events (such as intruders, blocked paths, opened locks, and moved containers) to observe how both the system and users would respond. Over the course of the EUA period, the four robots patrolled for a total of 665 hours and traveled 5940 kilometers (3691 miles). System

product tracking using RFID tags was found to be highly reliable, giving near-real-time notification of inventory discrepancies. Most importantly, both robot and MRHA developers gained valuable real-world data on hardware and software performance, as well as potential areas for improvement during the current rework prior to Production Qualification Test (PQT-2) in early 2006. ♦



MDARS Exterior robot on autonomous patrol at Hawthorne.

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